

The Impact of Interactive Storybook on Elementary School Students' Recall

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This study investigated the effectiveness of animated interactive storybook on elementary school students' recall. This experiment utilized 77 fourth grade students in three groups. Each student was randomly assigned with one of the three conditions: (1) computer presentation of interactive storybooks with animation; (2) computer presentation of storybooks without animation; and (3) traditional print storybooks. Students' recall was measured by using multiple-choice test. The researcher used quantitative methods to analyze participants' responses in the experiment. The results of statistical analysis indicated that there were significant differences in the students' recall scores. The students who read the computer presentation of storybooks with animation showed significantly higher recall scores than those who read the computer presentation of storybooks without animation and the traditional print version of storybooks. In other words, animation used in an interactive storybook may help students recall better than no animation use.

Keywords: animation, elementary education, interactive storybook, literacy, recall

Introduction

In the 21st century, important and radical changes are occurring in the area of literacy and digital technology is changing the nature of literacy (Reinking, McKenna, Labbo, & Kieffer, 1998). Many researchers, theorists and applied scholars support this changing and transforming the nature of literacy, especially within and across new interactive environments (Reinking, 1998; Reinking et al., 1998; Tierney, 2008). Duke, Schmar-Dobler and ZHANG (2006) stated that, "Electronic environments have the potential to be one of the best things to happen to the field of reading comprehension in this field's history" (p. 324). Moreover, "Electronic texts introduce new supports as well as new challenges that can have a great impact on an individual's ability to comprehend what he or she reads" (Coiro, 2003, p. 458).

In the mid-1990s, literacy in new digital age, New London group engaged in the implications of broad social, cultural and technological change for the conception of literacy. New London group expressed particular attention to multimedia, interactive hypermedia, and the shift from print-based literacy towards digital texts, on-screen texts and literacy (New London group, 1996). Print is often thought of as a traditional technology that often serves as barrier, rather than a gateway, to learning. Even though traditional print texts require interaction between the reader and texts, they are passive, non-interactive with non-adaptable features, static with two-dimensional images, and cannot response to individual readers, restricted by their linear composition, and rely heavily on the reader's internal strategies to activate prior knowledge (Doty, 1999; Pearman, 2008). On the other hand, interactive texts typically have different and new formats. These new formats are nonlinear,

non-sequential, interactive and can provide a literal interaction between the reader and the text (Coiro, 2003; Reinking, 1992; Schmar-Dobler, 2003; Sutherland-Smith, 2002).

Interactive storybooks are reading software for children in illustrated storybooks that help children develop visual recognition. In addition, these interactive storybooks offered more reading recall hints and a better background for stories than traditional printed texts (Doty, 1999; Reinking, 1998). Interactive storybooks are mainly designed to integrate texts, graphics, animations, music and other multimedia components in order to bring support to the story line (CHEN, Ferdig, & Wood, 2003; Glasgow, 1996-1997). Interactive storybook technology has significantly improved the potential to add animations for readers. Children could read the stories on their own or listen to the stories read and animate parts of illustrations.

Statement of the Problem

The problem was pointed out by Robb (2000), he claimed that, children's interests in reading for pleasure and motivations to read reduced. New technologies offered great opportunities and great challenges (Dalton & Strangman, 2006, p. 88). As a scaffold learning environment, digital texts provide support to the students with diverse learning needs. Digital learning environments, through good qualities of flexibility of the media, have the potential of scaffold instruction in a rich variety of ways (Bus, De Jong, & Verhallen, 2006). For example, images and animated graphics can be incorporated into digital texts to supplement textual definitions, supporting vocabulary understanding and reading recall (Anderson-Inman, Horney, CHEN, & Lewin, 1994; Boone & Higgins, 1993).

However, the results of the few available studies are not consistent. Some of the studies have shown that interactive storybooks elements may also potentially become distractions (De Jong & Bus, 2002; Matthew, 1996; Okolo & Hayes, 1996; Trushell & Maitland, 2005; G. Underwood & J. Underwood, 1998). De Jong and Bus (2002) revealed that children's understandings of a story's contents were less supported by the interactive version than the traditional print book format. Additionally, the illustrations, games and attractive pictorial options included in the story motivate children but if they were not matching with the story, they could distract the children's focus on the story instead of supporting the narrative's reading recall and cause passive reading, and delay children's early literacy developments (De Jong & Bus, 2002; Labbo & Kuhn, 2000; Matthew, 1996; Shamir & Korat, 2006; G. Underwood & J. Underwood, 1998).

Several questions remain unanswered such as do children passively view screens that distract their attentions away from the meaning making. Bus et al. (2006) emphasized that "additional work is needed to learn more about the effects of considerate animations as scaffolds to children's story reading comprehensions" (p. 134). More studies are needed to test which particular feature of interactive storybooks such as animation interactivity of texts have potential to improve students' recall when the story presented as static illustrations and animated illustrations (De Jong & Bus, 2002; Bus et al., 2006). For all these reasons, this study investigated the extent to animation of interactive storybooks which positively influence students' reading recall.

Purpose of the Study

The objective of this research is to investigate the effectiveness of animated interactive storybooks on elementary school students' recall. For this purpose, each student was presented with one of the three conditions: (1) interactive storybooks with animation; (2) storybooks without animation; and (3) printed version of storybooks. These three conditions were compared with respect to reading recall as measured by a multiple-choice test.

Significance of the Study

The results of the studies previously carried out in the reading area have been conflicting and are frequently hard to interpret. First, the animation effects were not controlled by the children. Second, narrated condition was integrated with animation as a part of storybooks. If there were any difference, it is not clear whether they come from narration and/or animation features of storybooks. Third, usually there was no obvious explanation or detail about what kind of illustrations or animations were used in the study. For this reason, in this study, the stories presented compared both static illustrations and animated illustrations. Narrative functions, word definitions and sound effects of storybooks were not used.

In summary, this research attempted to address some of the shortcomings of previous researches. This study provided empirical data to do specific and systematic investigation that confirms which features and types of story presentations are more effective than others to elementary students. Therefore, the following research question was addressed in this study: Are there any differences among reading recall scores as measured by the multiple-choice test when fourth grade students read the same storybooks presented in CD-ROM format with and without animation and a traditional print format?

Literature Review

Research findings are optimistic about the future of multimedia applications for readers. For example, Hegarty, Carpenter, and Just (1991) reported that animation in interactive texts help to illustrate unfamiliar processes for students with low mechanical abilities. Many features of interactive storybooks were well matched for phonemic awareness, phonics and fluency; vocabulary and reading comprehension (Pearman & Lefever-Davis, 2006). Computer software has the exceptional capacity to bring individualized practice to students who need to enhance their reading fluency (Oakley, 2003). The ability to recognize sound-symbol relationships is essential, but it is not enough for reading recall. Students must also activate their prior knowledge and use context hints to comprehend what they read. There is growing indication that computer-supported effects such as animation and sound allowing students to make these connections (Matthew, 1997). Greenlee-Moore and Smith (1996) indicated that the use of interactive storybooks might help improve reading recall of elementary students. In addition, interactive storybooks develop the story setting through animated graphics and sound effects indicating the story moods and events, and thus, supporting reading recall (Lefever-Davis & Pearman, 2005). Visual aids in interactive storybooks are helpful for understanding texts and building coherent mental representation. Multimedia presentation, which includes text, graphics, sounds, and animated images, is also a helpful motivation for a reader who is particularly uninterested.

This study is focused on animation in interactive storybooks. Literature review showed that there were little actual researches evaluating the use of animation in interactive storybooks. Scoresby (1996) reported that "there may be few researches which directly relate to the study of animations and narrative texts... literature implied a potential problem but failed to empirically establish that problem indeed exists, the need for actual research in this area is clear" (p. 31). Some authors caution about the potential distraction of animations in reading recall (Nibley, 1993; Okolo & Hayes, 1996; Scoresby, 1996). If animations do not support the text, they may draw students' attentions away from the main points of the text and even hinder reading recall. DeJean, Miller and Olson (1997) and Scoresby (1996) found that animation in interactive storybooks divert from reading rather than improve it and the animation slows down the recall of textual information. Scoresby

(1996) also revealed that animation-available groups spent most time engaged in reading interactive storybooks. However, this extra time on task did not cause higher recall scores; the animation-available groups had significantly lower recall scores than those who spent much less time within the storybook.

However, many studies have shown that illustrations and animations that support or amplify accompanying text improve students' reading recall. For example, Matthew (1996), L. Miller, Blackstock, and R. Miller (1994) demonstrated interactive storybooks in stimulating children in reading development. Trushell, Maitland, and Burrell (2003) found that graphic animations could offer background support for readers by providing supplemental information. Interactive storybooks combined sound effects and animations to provide rich context that supported vocabulary and concepts (ChanLin, 2001; Pearman & Lefever-Davis, 2006). Interactive storybook technology contains extensive sequences of animation that are not found in traditional texts (Ocolo & Hayes, 1996; Scoresby, 1996).

Methodology

The experimental design of the study used independent measurement. The participants were 77 students ($N = 77$) enrolled in a fourth grade classroom and from economically and culturally diverse elementary schools in the United States. The participants' ages ranged from 9 to 11, with a mean of 9.96 years. Forty-eight participants were female and 29 were male.

The multiple-choice questions were written by the researcher according to Pearson and Johnson's (1978) taxonomy of reading recall questions. Textually explicit (factual questions) and textually implicit (inferential questions) were used to examine whether the students recalled the elements of the story (Leslie, 1993). Content validity was used for validity evaluation of reading recall tests. Content validity is a subjective form of validity evaluation. It consists of opinion and judgment as the method to derive valid test. In more sophisticated situations, a test designer may begin with original instrument and then receive additional test item assessments from experts in the field. Items may be added, modified or dropped, according to the experts' opinions. This method is the strongest form of content validity (Balian, 1994).

Data Collection

Students who have previously read and/or seen the storybooks were eliminated in the study. Because the storybooks that were previously unknown to participants are important for this study. The first group of students ($N = 25$) read interactive storybooks with animation on the computer. The second group of students ($N = 26$) read without animation of storybooks on the computer. The third group of students ($N = 26$) read the same stories on print version.

Prior to data collection, students in the interactive storybook groups were given directions for using the computer. For the purpose of data collection, the students read the following storybook, which was published in both print and interactive CD-ROM format—Arthur's Teacher Trouble by Brown (1994).

After reading, the students answered on paper based 13 multiple-choice questions. The time limit was 20 minutes. They were not allowed access to the stories during the test. The reading recall tests contained multiple-choice questions that required the student to select the correct answer. Students received one point for correct responses, and zero points for an incorrect or missing response. The highest total possible score was 13 point for this assessment. The students' responses were to be scored by the researcher.

Data Analysis

ANOVA (one-way analysis of variance) was performed to compare the groups on the basis of outcome

measures at the significance level of 0.05. The SPSS (Statistical Package for Social Sciences) used for the purposes of data entry, manipulation, and analysis. According to Balian (1994), ANOVA is the most traditionally and widely accepted form of statistical analysis. ANOVA can test three or more group means utilizing a single statistical operation. ANOVA accomplishes its statistical testing by comparing variance among the groups to the variance within each group. A significantly statistical finding would indicate that group means were significantly different from each other. In case of a significant statistical finding, there is a need to use a Post-Hoc test to find exactly which groups differed from other groups (Balian, 1994). In this study, because of a significant finding from ANOVA, Bonferroni test was used to find exactly which group differed from others.

Results

ANOVA indicated that there were a significant differences in reading recall scores on a multiple-choice test ($F = 12.529$; $p < 0.05$) among students reading interactive storybooks with animation, storybooks without animation and traditional print storybooks. For the reading recall scores on a multiple-choice reading recall test, a higher level of reading recall score was reported in the reading interactive storybooks with animation condition ($M = 9.60$, $SD = 3.15$), followed by traditional print storybooks condition ($M = 7.62$, $SD = 2.37$) and storybooks without animation condition ($M = 6.19$, $SD = 1.58$). The results are displayed in Table 1.

Table 1

Analysis of Variance for Reading Recall

	<i>df</i>	<i>F</i>	Significance		<i>N</i>	<i>Mean</i>	<i>SD</i>
Reading recall test total: Between groups	2	12.529	0.000	With animation	25	9.6000	3.1491
Within groups	74			Without animation	26	6.1923	1.5753
Total	76			Printed	26	7.6154	2.3677

Notes. *df* = Degree of freedom; *F* = Fisher's *F* ratio; *SD* = Standard deviation.

The results of the Post-Hoc test comparing three groups in terms of the reading recall are provided in Table 2.

Table 2

Post-Hoc (Bonferroni) Test Results for Reading Recall Scores

(I) Conditions	(J) Conditions	Mean difference (I-J)	Standard error	Significance
With animation $N = 25$, $M = 9.6000$, $SD = 3.1491$	Without animation	3.4077	0.6832	0.000*
	Printed	1.9846	0.6832	0.015*
Without animation $N = 26$, $M = 6.1923$, $SD = 1.5753$	With animation	-3.4077	0.6832	0.000*
	Printed	-1.4231	0.6764	0.116
Printed $N = 26$, $M = 7.6154$, $SD = 2.3677$	With animation	-1.9846	0.6832	0.015*
	Without animation	1.4231	0.6764	0.116

Note. * = The mean difference is at the significant level of 0.05, * $p < 0.05$.

According to the Bonferroni Post-Hoc test results, significant differences were found between the interactive storybooks with animation group and the interactive storybooks without animation group ($p < 0.05$), between the interactive storybooks with animation and the traditional print storybook ($p < 0.05$). There was no

significant difference between the storybooks without animation and the traditional print storybooks ($p = 0.116$) (see Table 2).

Conclusions

The goal of this study was to compare and explore the effects of the media of storybooks presentations on students' reading recall. Three different presentations of storybooks, with animation, without animation format and traditional paper based format were compared with respect to reading recall as measured by the multiple-choice test.

The study provided some encouraging results relevant to those interested in the use of new digital technology to improve the fourth grade students' reading recall at the elementary school level. Reading recall scores were higher for students reading the interactive storybooks with animation than those reading the storybooks without animation (static illustration) and printed storybooks.

Although, there were some concerns about interactive texts that could distract the attention of students, they could also cause cognitive overload and damage reading recall of these readers (Duke et al., 2006). This study found that interactive storybooks might be beneficial in helping students better understand the narratives and animation feature of interactive storybooks which have the potential to improve students recall.

A possible explanation of higher reading recall scores for interactive storybooks with animation group lies in the interactivity that storybooks allow. The rich visual support and animation in the interactive storybooks used in this study may be a reason that influenced the amount of reading recall. Sutherland-Smith (2002) stated that images in interactive texts were more lifelike than in traditional print texts.

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